SOLDIERS TRACKING
AND
HEALTH ANALYSIS SYSTEM

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ABSTRACT

The project is aim to tract the soldiers real time positions and the health indication parameters so that we can protect our nation from the rivals. During war and Search operations our protectors are injured and many of them are lost from their battalion, that time this project gives an ability to track the location and analyse health of the soldiers in real time who become lost and get injured in the battlefield. It helps to save the time, search and rescue operation efforts of soldier control unit. This system enables to army base station to track the location and monitor health of soldiers using GPS module and body sensor, such as temperature sensor, heartbeat sensor, Atmospheric pressure sensor and gas level indicator sensor etc. The data coming from sensors and GPS receiver is transmitted wirelessly using ZigBee module. Also, a soldier can ask for help from army control room and can communicate with other fellow soldier.

Keywords— *ZigBee, GPS, Temperature sensor, Heartbeat sensor, Atmospheric Pressure sensor, Gas sensor, Arduino microprocessor(ATMega328).*

I INTRODUCTION

"A soldier lives by chance, loves by choice and kills by profession." The infantry soldier of tomorrow promises to be one of the most technologically advanced modern warfare has ever seen. Alongside vast improvements in protective and weaponry Sub systems, another major aspect of this technology will be the ability to provide information superiority at the operational edge of military networks by equipping the dismounted soldier with advanced visual, voice, and data communications. In our project, we are trying to provide an embedded wireless system by which the Army base stations can monitor the heart beat count, Atmospheric pressure and gas level, body as well as atmospheric temperature by using sensor networks (WBASNs) such as temperature sensor, heart beat sensor, Biometric pressure sensor, gas sensor etc. Base stations can also know the location of soldiers by tacking them through Global positioning system (GPS) and can guide them to any safe area. Also, the soldier can ask for his location from army control unit in case if he feels that he is lost or to plan any new strategies against enemies.

In this project, all the processes are in real time because of the use of Arduino microprocessor (ATmega 328). The sensed data and the tracked location of soldiers will be transmitted wirelessly using ZigBee module. In military operations, one of the fundamental challenges is that the soldiers are not able to communicate with control room and sometimes not even with the other fellow soldiers. Once a troop or a soldier become lost during fight in battlefield due to some unfavorable environment or adverse fight conditions, then it becomes more difficult to search them and bring back to the army base station. In addition, every defense organization needs to design and develop some advance, small, portable and robust system to provide safety measures to their soldiers.

There are many problems which are faced by soldiers during wars in battlefield, like:
1. Sometimes soldiers want to know their location when they become lost but they are not able to do so.
2. Sometimes soldiers need some help during panic situations but they are not able to ask for help.

3. Sometimes soldiers are not able to get help when they get injured during war.

The system proposed by us is composed of two parts, one is small n portable unit for soldiers and other is for army control unit. The soldiers unit consists of an Arduino microprocessor (ATmega 328), GPS tracking device, ZigBee transceiver, heart beat sensor, temperature sensor, barometer and CO_2 level sensor etc. Where, GPS device is use to track the location of the soldiers with the help of satellite communication system. The heart beat sensor also called pulse rate sensor is use to sense the pulses or heart beats of human heart, and temperature sensor is used to sense the temperature of human body.
All the processed and sensed data are transmitted through a ZIGBEE module, which is a low power, low data rate transceiver used to transmit and receive the data wirelessly.

In this project, our main aim to improve the communication between soldiers and army control room by using advance and highly efficient, powerful systems. This project helps in to solve above mentioned problems as follows:
1. By using GPS device, it is possible to provide proper information about the location of soldiers when it is needed.
2. It will become possible to help the soldiers in panic situations when it is ask, by communicating with them, using ZigBee technology.
3. It will become easy to provide medical assistance to soldiers when they get injured.

II MOTIVATION

India today faces the most complex threats and challenges that range from nuclear to sub-conventional spectrum of conflict. Issues such as the unresolved territorial disputes with China and Pakistan, the insurgency in Jammu and Kashmir (J&K) and the North-Eastern states, the growing menace of left-wing extremism and the rising threat of urban terrorism has further exacerbated India's security environment. In the regional security milieu, it has clearly emerged that China poses the most potent military threat to India—given the advantages it has over India in nuclear, missile and military hardware. Moreover, the China-Pakistan nexus and increased strategic engagements between the two have increased the probability that India might face a two-front war in the future.

On the basis of recent incident, **"Lance Naik Hanumantappa Koppad"** was buried under the ice boulders up to 35 feet down due to unfavoured weather. And his existence was known after five and half hours through radio set, but they were unable to track his location. Fortunately, rescuers were able to access the telephone cable which could lead them to the location where the soldiers were buried. But it was not easy and couldn't help. So the team eventually kept digging with basic tools. Finally, after digging vigorously for six days, he was found. This incident inspired us to create or work on the device which would overcome all the drawbacks of present military system.

II RELATED WORK

Shruti Nikam, Supriya Patil, Prajkta Powar, V. S. Bendre had presented paper the tracking of the location of the soldiers when they enter the enemy land. For tracking their location GPS(SR87 series) module was used which is highly sensitive and it can track upto 20 satellites at a time that helps in finding the accurate position of the soldier. Along with tracking the paper also incorporates the soldier safety and security aspects such as monitoring the blood pressure and temperature of the soldier. LM35 sensor and pulse rate sensor was used that are not very complex and can be easily fitted in a tiny device. ARM processor (LPC2138) which follows the principles and basic theory of on a 32 bit ARM7 TDMI-S CPU and which gives a very high speed communication. ARM processor is interfaced with graphical LCDs to display various parameters like height, speed, body temperature and pulse rate [1].

Richard B. Marth and et.al have introduces an integrated navigation system for the soldiers. DRM(Dead Reckoning Modules) and GPS constitute the main components of this integrated system. For decades, the soldiers have used all the conventional basic tools such as compass and other navigation tools while they are on their mission. DRM replaces the need for a compass as it allows reliable and hands-free navigation. DRM consists of an analog circuit and a digital circuit. Analog board has magnetometers, accelerometer, temperature sensor and a barometric altimeter. These components are useful to determine the horizontal component of magnetic field, number of steps taken by soldiers, temperature etc. RS232 serial interface ports are used by DRM for communication. Kalman filter is used in integration mode that makes use of both GPS and DRM. This filter can adjust the step size, body offset as well as spurious jumps in

GPS position. Thus, the integrated navigation system allows soldiers to focus on the mission because of automatic pace count and indication of the direction and distance to waypoints which helps soldiers to avoid obstacles in their path [2].

Vongsagon Boonsawant and et.al have proposed a basic prototype system based on wireless sensor networks for monitoring temperature in a building. Xbee wireless communication module which is based on the IEEE 802.15.4 standard was proposed for that kind of a system. WSNs are combination of wireless communication and embedded system allowing transmission of data among various sensor networks. The prototype system was developed for temperature monitoring remotely in each classroom of SIIT. Arduino board that comes with ATMEGA168 is easily interfaced with Zigbee modules. This system consists of two types of nodes co-ordinator and end devices that were deployed within SIIT building which collected temperature readings every one hour [3].

Harshavardhan B. Patil and et.al have presented the design and implementation of biomedical parameter monitoring system of patients. The different health parameters measured include ECG monitoring, pulse rate, blood pressure and body temperature. The system consists of two sections: transmitter section (patient's side) and receiver section (doctor's side). The patient is wirelessly monitored and all the data from biomedical sensors are transmitted to microcontroller unit Arduino Uno and then Zigbee module is used to transmit this data to receiver section which is present in the doctor's cabin. LCD is used at both the sections i.e. transmitter and receiver sections to display all the output values from biomedical sensors. This project proves to be very helpful for doctors, as they can analyse the health condition of patients and provide necessary diagnosis and cure the patients quickly [4].

P.S. Kurhe, S.S. Agrawal had introduced a system that gives ability to track the soldiers at any moment. Additionally, the soldiers will be able to communicate with control room using GPS coordinate information in their distress. The location tracking has great importance since World War II, when military forces realized its usefulness for navigation, positioning, targeting and fleet management. This system is reliable, energy efficient for remote soldier health monitoring and their location tracking. It is able to send the sensed and processed parameters of soldier in real time. It enables to army control room to monitor health parameters of soldiers like heartbeat, body temperature, etc. using body sensor networks. The parameters of soldiers are measured continuously and wirelessly transmitted using GSM [5].

The literature review suggests that WSNs have been finding its efficient applications in health monitoring areas since time immemorial. Consequently, the proposed embedded system (an application of WSN) will be able to meet the tasks at hand efficiently. Also, the studies suggest that ZigBee is proficient enough to accomplish communication between the two ends.
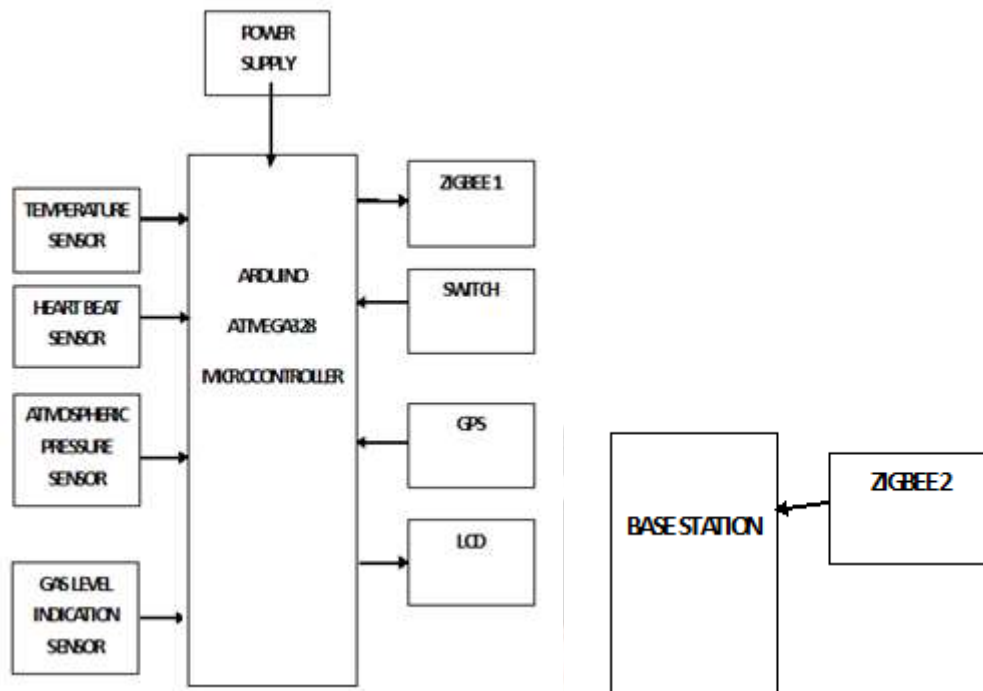
III PROPOSED SYSTEM

The Architecture of our proposed system is composed of two parts:

A. Soldiers Unit Room Unit

B. Control Room Unit

A. Soldier's Unit:

This unit consists of body area sensor networks such as temperature sensor and heart beat sensor. These sensors are used to sense the health parameters of soldiers. Temperature sensor will sense the body temperature of soldier and give that sensed data to microcontroller. The heart beat sensor will sense the pulse rate or heart beats of soldiers in beats per minute (BPM) and give it to the microcontroller to process. These sensed analog signals will be converted into digital signals using analog to digital converter and then compared with the normal condition signals. And if any discrepancy occurs between sensed signals and defined normal signals, then it will be considered as an emergency. There will be a GPS modem is used to trace the location of soldiers at any moment from anywhere. The GPS receivers are space-based satellite navigation systems that provide location and time information in all weather conditions from anywhere on or near the earth. The data coming from GPS receiver will pass to microcontroller through IC MAX-232 which converts RS-232 voltage level data to TTL voltage level data and vice versa. The IC MAX-232 is a dual driver/receiver which converts typically RX, TX, CTS, and RTS signals.

All the data coming from sensors and GPS modem are processed by Arduino microprocessor embedded in ATMega328 microcontroller. A microprocessor is a single integrated circuit (IC), which is a multipurpose programmable device that takes digital data as input, processes it according to the instructions stored in its memory and provide results as output.

A ZigBee transceiver is used to transmit the data, coming from sensors and GPS receiver through microcontroller, to the army control room wirelessly. A ZigBee is low cost, low power, wireless mesh network standard especially designed and developed for long battery life devices in wireless controlling and monitoring applications. ZigBee devices have low latency which can further reduce the average current.

Additionally, an alphanumeric LCD display is used to display the health parameters (i.e. body temperature and heart beats) and location information of soldier. Also a buzzer and a panic switch are provided. A soldier can press the panic switch to ask for help in panic situation from army control room and from another fellow soldier within the wireless range. The buzzer of other fellow soldier will sound when panic button is pressed by the soldier in panic condition.

B. Control Room Unit:

The army base station unit consists of a PC and a ZigBee transceiver. The ZigBee module will be connected to PC with the help of PL-2303 USB-to-Serial driver installed in that PC. The data coming from ZigBee module will be displayed on PC screen with the help of graphical user interface (GUI) coded using visual basic language.

Modules Description:

1) ATmega328 (Arduino uno)

The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz

2) ZigBee

ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network.

3) GPS(SR87)

SR-87 series GPS modules incorporates high sensitivity, high performance design. The module tracks up to 20 satellites at a time while offering fast time-to-first-fix and 1Hz navigation update. SR-87 design utilizes the latest surface mount technology and high level circuit integration to achieve superior performance while minimizing dimension and power consumption The module communicates with application system via RS232 (TTL level) with NMEA-0183 protocol.

4) Temperature Sensor (LM35)

To find the health status of soldier we are measuring body temperature, pulse rate using sensors. We are using LM35 as it is a low cost temperature sensor and it does not require signal conditioning. Pulse rate sensor is used or pulse rate measurement. **LM 35** is a precision integrated circuit temperature sensor whose output voltage is linearly proportional to temperature.

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5) HeartBeat Sensor

HeartBeat **sensor** gives digital output of heart beat when finger is placed on it. It works on the principle of light modulation by blood flow through finger at each pulse.

6) Atmospheric Pressure Sensor

This is a Grove module for the Bosch BMP180 high-precision, low-power digital barometer. The BMP180 offers a pressure measuring range of 300 to 1100 hPa with an accuracy down to 0.02 hPa in advanced resolution mode. -40 to +85°C operational range, ±2°C temperature accuracy

7) Gas Level Indicator Sensor

They are used in air quality control equipment's for buildings/offices, are suitable for detecting of NH3, NOx, alcohol, Benzene, smoke,CO2 ,etc.
Wide detecting scope.
Fast response and High sensitivity.
Stable and long life.

8) LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

V BIOSENSORS AND PHYSIOLOGICAL SIGNALS

With recent advances in technology, various wearable sensors have been developed for the monitoring of human physiological parameters. The various sensing technologies are available, which can be integrated as a part of health monitoring system, along with their corresponding measured physiological signal. The measurement of these vital bio-signal and their subsequent processing for feature extraction, lead to collection of real time gathered physiological parameter which can give an overall estimation of health condition at any real time There are a number of medical parameters of soldier that can be monitored, like ECG, EEG, Brain Mapping, etc. But these require complex circuitry and advanced medical facilities and hence they cannot be carried around by the soldier. The entire system would become bulky for the soldier. We therefore use two simple parameters temperature of the soldier and blood Pressure of the soldier, which does not require too complex circuits and can be easily fitted into a small device that can be carried by the soldier. We are using LM35 as it is a low cost temperature sensor and it does not require signal conditioning. Pulse rate sensor is used or pulse rate measurement it works on the principle of light modulation by blood flow through finger at each pulse.

VI FEATURES

1. FEATURES
   1.1 This System provides the accurate data of longitude and latitude of soldier.
   1.2 It can be easily fitted in pocket due to its compact size.
   1.3 We can track soldier anywhere in the world.

2. ADVANTAGES
   2.1 Effective tracking of Soldier can be done.
   2.2 Used to monitor and provide health status of soldier continuously.
   2.3 Low cost, high reliable.
   2.4 Very compact device, so we can easily fit it into soldier costume.
   2.5 System is less complex so installation is easy.
   2.6 Low power consumption.
   2.7 Continuous data logging can provide the analysis for different soldiers.
   2.8 Due to use of advanced technology and advanced equipment's, this system will fulfil all the requirements of growing technologies

VII CONCLUSION

These devices will improve situational awareness, not only for the host, but also for collocated military personnel who will exchange information using wireless networks. The outcome is the integration of piecemeal components into a lightweight package that leads to desired result without being too bulky and requiring too much power. One of the fundamental challenges in military operations lies that the soldiers are not able to communicate with control room station. With our proposed device, this is made possible. In addition, the proper navigation between soldier's organizations plays important role for careful planning and co-ordination. Biosensors help us to notify active soldiers.

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